- High Performance Concrete

concrete is considered as durable and strong material.
Reinforced concrete is one of the most popular materials used for construction around the world. Reinforced concrete is exposed to deterioration in some regions especially in coastal regions. Therefore researchers around the world are directing their efforts towards developing a new material to overcome this problem. Invention of large construction plants and equipments around the world added to the increased use of material. This scenario leads to the use of additive materials to improve the quality of concrete. As an outcome of the experiments and researches, cement based concrete which meets special performance with respect to workability, strength and durability known as" High Performance Concrete" was developed. High Performance Concrete can be designed to give optimized performance characteristics for a given set of load, usage and exposure conditions consistent with the requirements of cost, service life and durability. The high performance concrete does not require special equipments except careful design and production. High performance concrete has several advantages like improved durability characteristics and much lesser micro cracking than normal strength concrete.

High performance concrete (HPC) is that which is designed to give optimized performance characteristics for the given set of materials, usage and exposure conditions, consistent with requirement of cost, service life and durability. The American Concrete Institute (ACI) defines HPC ''as concrete which meets special performance and uniformity requirements that cannot always be achieved routinely by using only conventional materials and nominal mixing, placing, and curing practices." The performance may involve enhancements of characteristics such as placement and compaction without segregation, long-term mechanical properties, and early age strength or service life in severe environments.

Introduction

The American Concrete Institute (ACI) defines HPC ''as concrete which meets special performance and uniformity requirements that cannot always be achieved routinely by using only conventional materials and nominal mixing, placing, and curing practices." The performance may involve enhancements of characteristics such as placement and compaction without segregation, long-term mechanical properties, and early age strength or service life in severe environments. High performance in a broad manner can be related to any property of concrete. It can mean excellent workability in the fresh state like self-leveling concrete or low heat of hydration in case of mass concrete, or very rigid setting and hardening of concrete in case of sprayed concrete or quick repair of roads and airfields, or very low imperviousness of storage vessels, or very low leakage rates of encapsulation containments for contaminating material.

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Also, the concrete must have a durability factor greater than 80 after 300 cycles of freezing and thawing to meet their definition. "All high-strength concrete is high-performance concrete, but not all high-performance concrete is high-strength concrete," says Henry G. Russell, consulting engineer and former chairman of the American Concrete Institute's high-performance concrete committee. High-performance concrete (HPC) is not one product but includes a range of materials with special properties beyond conventional concrete and routine construction methods. Any concrete which satisfies certain criteria proposed to overcome limitations of conventional concretes may be called High Performance Concrete.

It may include concrete, which provides either substantially improved resistance to environmental influences or substantially increased structural capacity while maintaining adequate durability. It may also include concrete, which significantly reduces construction time to permit rapid opening or reopening of roads to traffic, without compromising long-term serviceability. Therefore it is not possible to provide a unique definition of High Performance Concrete without considering the performance requirements of the intended use of the concrete

Objectives

To put the concrete in to service at much earlier age, for example opening the pavement at 3-days.¬

To build high-rise buildings by reducing column sizes and increasing available space.¬

To build the superstructures of long-span bridges and to enhance the durability of bridge decks.¬

To satisfy the specific needs of special applications such as durability, modulus of elasticity, and flexural strength. Some of these applications include dams, grandstand roofs, marine foundations, parking garages, and heavy industrial floors.¬

General Characteristics

High-performance concrete characteristics are developed for particular applications and environments; some of the properties that may be required include:

High strength¬

High early strength¬

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High modulus of elasticity¬

High abrasion resistance¬

High durability and long life in severe environments¬

Low permeability and diffusion¬

Resistance to chemical attack¬

High resistance to frost and deicer scaling damage¬

Toughness and impact resistance¬

Volume stability¬

Ease of placement¬

Compaction without segregation¬

Inhibition of bacterial and mold growth¬

Advantages of High Performance Concrete

The advantages of using high strength high performance concretes often balance the increase in material cost. The following are the major advantages that can be accomplished.

Reduction in member size, resulting in increase in plinth area/useable area and direct savings in the concrete volume saved.¬

Reduction in the self-weight and super-imposed dead load with the accompanying saving due to smaller foundations.¬

Reduction in form-work area and cost with the accompanying reduction in shoring and stripping time due to high early-age gain in strength.¬

Construction of High –rise buildings with the accompanying savings in real-estate costs in congested areas.¬

Longer spans and fewer beams for the same magnitude of loading.¬

Reduced axial shortening of compression supporting members.¬

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Reduction in the number of supports and the supporting foundations due to the increase in spans.¬

Reduction in the th¬ickness of floor slabs and supporting beam sections which are a major component of the weight and cost of the majority of structures.

Superior long-term service performance under static, dynamic and fatigue loading.¬

Low creep and shrinkage.¬

Greater stiffness as a result of a higher modulus of elasticity¬

Higher resistance to freezing and thawing, chemical attack, and significantly improved long-term durability and crack propagation.¬

Reduced maintenance and repairs.¬

Smaller depreciation as a fixed cost.¬

Limitations

High Performance Concrete has to be manufactured and placed much more carefully than normal concrete.¬

An extended quality control is required¬

In concrete plant and at delivery site, additional tests are required. This increases the cost¬

Some special constituents are required which may not be available in the ready mix concrete plants.¬